

--24. The process according to claim 23, wherein the first type of aluminum-containing compound is aluminum trihydrate.--

--25. The process according to claim 23, wherein the first type of aluminum-containing compound is thermally treated aluminum trihydrate.--

REMARKS

Claims 4-5 and 9-25 are pending. By this Preliminary Amendment, claims 1-3 and 6-8 are canceled, claims 4-5 and 9-15 are amended and new claims 16-25 are added. Prompt and favorable examination on the merits is respectfully requested.

Respectfully submitted,



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Attachments:
Appendix
Abstract

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ABSTRACT OF THE DISCLOSURE

An economical and environment-friendly process for the synthesis of anionic clays with carbonate and/or hydroxide anions as the charge-balancing interlayer species is disclosed. The process involves reacting a slurry comprising an aluminum source and a magnesium source, the aluminum source comprising two types of aluminum-containing compounds, preferably aluminum trihydrate and/or thermally treated calcined aluminum trihydrate. There is no necessity to wash or filter the product. It can be spray dried directly to form microspheres or can be extruded to form shaped bodies. The product can be combined with other ingredients in the manufacture of catalysts, absorbents, pharmaceuticals, cosmetics, detergents, and other commodity products.

APPENDIX

Changes to Abstract:

The following is a marked-up version of the amended Abstract.

~~This patent describes an~~ An economical and environment-friendly process for the synthesis of anionic clays with carbonate and/or hydroxide anions as the charge-balancing interlayer species is disclosed. ~~It~~ The process involves reacting a slurry comprising an ~~aluminium-aluminum~~ aluminum source and a magnesium source, the ~~aluminium-aluminum~~ aluminum source comprising two types of ~~aluminium~~ aluminum-containing compounds, preferably ~~aluminium~~ aluminum trihydrate and/or thermally treated calcined ~~aluminium~~ aluminum trihydrate. There is no necessity to wash or filter the product. It can be spray dried directly to form microspheres or can be extruded to form shaped bodies. The product can be combined with other ingredients in the manufacture of catalysts, absorbents, pharmaceuticals, cosmetics, detergents, and other commodity products.

Changes to Specification:

Page 1, lines 14-20:

In hydrotalcite-like anionic clays the brucite-like main layers are built up of octahedral alternating with interlayers in which water molecules and anions, more particularly carbonate ions, are distributed. The interlayers may contain anions such as NO_3^- , OH^- , Cl^- , Br^- , I^- , SO_4^{2-} , SiO_3^{2-} , CrO_4^{2-} , BO_3^{2-} , MnO_4^- , HGao_3^{2-} , HVO_4^{2-} , ClO_4^- , BO_3^{2-} , pillaring anions such as $\text{V}_{10}\text{O}_{28}^{6-}$ and $\text{Mo}_7\text{O}_{24}^{6-}$, monocarboxylates such as acetate, dicarboxylates such as oxalate, and alkyl sulphonates such as laurylsulphonate.

Page 1, lines 22-26:

It should be noted that a variety of terms are used to describe the material which is referred to ~~in this patent herein~~ as an anionic clay. Hydrotalcite-like and layered double hydroxide are interchangeably used by those skilled in the art. ~~In this patent application we refer to~~ Herein, the materials are referred to as anionic clays, comprising within that term hydrotalcite-like and layered double hydroxide materials.

Page 2, lines 3-10:

Recently, two major reviews of anionic clay chemistry were published in which the synthesis methods available for anionic clay synthesis have been summarized, F. Cavani et al., "Hydrotalcite-type anionic clays: Preparation, Properties and Applications," Catalysis Today", 11 (1991) Elsevier Science Publishers B. V. Amsterdam.

J P Bessee and others, "Anionic clays: trends in pillary chemistry, its synthesis and microporous solids" (1992), 2, 108, editors: M.I. Occelli, H.E. Robson, Van Nostrand Reinhold, N.Y.

Page 2, lines 12-19:

In these reviews the authors state that a characteristic of anionic clays is that mild calcinations at 500°C results in the formation of a disordered MgO-like product. ~~Said~~ The disordered MgO-like product is distinguishable from spinel (which results upon severe calcination) and from anionic clays. ~~In this patent application we refer to said~~ Herein, the disordered MgO-like materials are referred to as Mg-Al solid solutions. Furthermore, these Mg-Al solid solutions contain a well-known memory effect whereby the exposure to water of such calcined materials results in the reformation of the anionic clay structure.

Page 3, lines 10-17:

In US Patent No. 3,796,792 by Miyata entitled "Composite Metal Hydroxides" a range of materials is prepared into which an extensive range of cations is incorporated,

including Sc, La, Th, In, etc. In the examples given solutions of the divalent and trivalent cations are prepared and mixed with base to cause co-precipitation. The resulting products are filtered, washed with water, and dried at 80°C. Example 1 refers to Mg and Al and Example 2 to Mg and Bi. Other examples are given, and in each case soluble salts are used to make solutions prior to precipitation of the anionic clay at high pH.

Page 3, lines 19-27:

In US Patent No. 3,879,523 by Miyata entitled "Composite Metal Hydroxides" also a large number of preparation examples is outlined. The underlying chemistry, however, is again based on the co-precipitation of soluble salts followed by washing and drying. It is important to emphasize that washing is a necessary part of such preparations, because to create a basic environment for co-precipitation of the metal ions a basic solution is needed and this is provided by NaOH/Na₂CO₃ solutions. Residual sodium, for example, can have a significant deleterious effect on the subsequent performance of the product as a catalyst or oxide support.

Page 4, line 1:

In US Patent No. 3879525 (Miyata) very similar procedures are again described.

Page 4, lines 3-10:

In US Patent No. 4,351,814 to Miyata et al. a method for making fibrous hydrotalcite is described. Such materials differ in structure from the normal plate-like morphology. The synthesis again involves soluble salts. For example, an aqueous solution of a mixture of MgCl₂ and CaCl₂ is prepared and suitably aged. From this a needle-like product Mg₂(OH)₃Cl.4H₂O precipitates. A separate solution of sodium aluminate is then reacted in an autoclave with the solid Mg₂(OH)₃Cl.4H₂O and the product is again filtered, washed with water, and dried.

Page 4, lines 12-16:

In US Patent No. 4,458,026 to Reichle, in which heat-treated anionic clays are described as catalysts for aldol condensation reactions, again use is made of magnesium and ~~aluminium~~-aluminum nitrate salt solutions. Such solutions being added to a second solution of NaOH and Na₂CO₃. After precipitation the slurry is filtered and washed twice with distilled water before drying at 125°C.

Page 4, lines 18-25:

In US Patent No. 4,656,156 to Misra the preparation of a novel absorbent based on mixing activated alumina and hydrotalcite is described. The hydrotalcite is made by reacting activated MgO (prepared by activating a magnesium compound such as magnesium carbonate or magnesium hydroxide) with aqueous solutions containing aluminate, carbonate and hydroxyl ions. As an example the solution is made from NaOH Na₂CO₃ and Al₂O₃. In particular, the synthesis involves the use of industrial Bayer liquor as the source of Al. The resulting products are washed and filtered before drying at 105°C.

Page 4, line 27 - page 5, line 1:

In US Patent No. 4,904,457 to Misra a method is described for producing hydrotalcites in high yield by reacting activated magnesia with an aqueous solution containing aluminate, carbonate, and hydroxyl ions.

Page 5, line 3:

The methodology is repeated in US Patent No. 4,656,156.

Page 5, lines 5-12:

In US Patent No. 5,507,980 to Kelkar et al. a process is described for making novel catalysts, catalyst supports, and absorbers comprising synthetic hydrotalcite-like binders. The synthesis of the typical sheet hydrotalcite involves reacting pseudo-boehmite to which acetic acid has been added to peptize the pseudo-boehmite. This is then mixed with

magnesia. More importantly, the patent summary states clearly that the invention uses mono carboxylic organic acids such as formic, propionic and isobutyric acid. In this patent the conventional approaches to preparing hydrotalcite are presented.

Page 5, lines 14-18:

In US Patent No. 5,439,861 a process is disclosed for preparing a catalysts for synthesis gas production based on hydrotalcite. The method of preparation is again based, on the co-precipitation of soluble salts by mixing with base, for example, by the addition of a solution of RhCl_3 , $\text{Mg}(\text{NO}_3)_2$ and $\text{Al}(\text{NO}_3)_3$ to a solution of Na_2CO_3 and NaOH .

Page 5, lines 20-22:

Also in US Patent No. 5,399,537 to Bhattacharyya in the preparation of nickel-containing catalysts based on hydrotalcite use is made of the co-precipitation of soluble magnesium and ~~aluminium~~-aluminum salts.

Page 5, lines 24-28:

In US Patent No. 5,591,418 to Bhattacharyya a catalyst for removing sulfur oxides or nitrogen oxides from a gaseous mixture is made by calcining an anionic clay, ~~said the~~ anionic clay having been prepared by co-precipitation of a solution of $\text{Mg}(\text{NO}_3)_2$, $\text{Al}(\text{NO}_3)_3$ and $\text{Ce}(\text{NO}_3)_3$. The product again is filtered and repeatedly washed with de-ionized water.

Page 6, lines 1-7:

In US Patent No. 5,114,898/WO 9110505 Pinnavaia et al. describe layered double hydroxide sorbents for the removal of sulfur oxide(s) from flue gases, which layered double hydroxide is prepared by reacting a solution of Al and Mg nitrates or chlorides with a solution of NaOH and Na_2CO_3 . In US Patent No. 5,079,203/WO 9118670 layered double hydroxides intercalated with polyoxo anions are described, with the parent clay being made by co-precipitation techniques.

Page 6, lines 9-14:

In US Patent No. 5,578,286 in the name of Alcoa a process for the preparation of meixnerite is described. ~~Said~~ The meixnerite may be contacted with a dicarboxylate or polycarboxylate anion to form a hydrotalcite-like material. In comparative examples 1-3 hydromagnesite is contacted with ~~aluminium~~ aluminum trihydrate in a CO₂ atmosphere, greater than 30 atmospheres. No hydrotalcite was obtained in these examples.

Page 6, lines 16-19:

In US Patent No. 5,514,316 a method for the preparation of meixnerite is described using magnesium oxide and transition alumina. For comparative purposes ~~aluminium~~ aluminum trihydrate was used in combination with magnesium oxide. It was indicated that this method did not work as well as the transition alumina.

Page 6, lines 21-22:

US Patent Nos. 4,454,244 and ~~US~~ 4,843,168 describe the use of pillaring anions in anionic clays.

Page 6, lines 24-28:

In US Patent Nos. 4,946,581 and ~~US~~ 4,952,382 to van Broekhoven co-precipitation of soluble salts such as Mg(NO₃)₂ and Al(NO₃)₃ with, and without the incorporation of rare earth salts was used for the preparation of anionic clays as catalyst components and additives. A variety of anionic and di- and tri-valent cations are described.

Page 7, lines 9-26:

Because of this wide variety of large-scale commercial applications for these materials, new processes utilizing alternative inexpensive raw materials and which can be carried out in continuous mode are needed to provide a more cost-effective and environmentally compatible processes for making anionic clays. In particular, from the prior art described above one can conclude that the preparation process can be improved in the

following ways: the use of cheaper sources of reactants, processes for easier handling of the reactants, so that there is no need for washing or filtration, eliminating the filtration problems associated with these fine-particled materials, the avoidance of alkali metals (which can be particularly disadvantageous for certain catalytic applications): In prior art preparations organic acids were used to peptize alumina. The use of organic acids is expensive and introduces an additional step in the synthesis process and is therefore not cost-effective. Further, in drying or calcining the anionic clay prepared by prior art processes gaseous emissions of nitrogen oxides, halogens, sulfur oxides, etc. are encountered which cause environmental pollution problems. Moreover, none of the preparation methods described in the prior art provide continuous processes for the preparation of anionic clays.

Page 8, lines 3-10:

Our invention includes a process for producing anionic clays using raw materials which are inexpensive and utilizing such raw materials in a simple process which is extremely suitable to be carried out in continuous mode. ~~Said~~ The process involves reacting mixtures with or without stirring in water at ambient or elevated temperature at atmospheric or elevated pressure. Such continuous processes can be operated in standard industrial equipment. More specifically, there is no need for washing or filtering, and a wide range of ratios of Mg/Al in the reaction product is possible.

Page 8, lines 11-26:

In the process according to the invention an ~~aluminium~~ aluminum source and a magnesium source, for instance magnesium oxide or brucite, are reacted in aqueous suspension to obtain an anionic clay. The ~~aluminium~~ aluminum source comprises two types of ~~aluminium~~ aluminum-containing compounds, for instance alumina trihydrate (such as gibbsite, bayerite or nordstrandite) and thermally treated forms thereof. The reaction is carried out at ambient or elevated temperature and ambient or elevated pressure and the

reaction mixture results in the direct formation of an anionic clay which can be obtained by simply drying the slurry continuously retrieved from the reactor. The powder X-ray diffraction pattern (PXRD) suggests that the product is comparable to anionic clays made by other standard (batch) methods. The physical and chemical properties of the product are also comparable to those anionic clays made by the other conventional methods. The overall process of this invention is very flexible, enabling a wide variety of anionic clay compositions and anionic clay-like materials involving for example carbonate, hydroxide and other anions to be prepared in an economically and environmental-friendly manner.

Page 9, line 18 - page 10, line 5:

This invention involves the preparation of anionic clays. In particular it describes a process for the preparation of an anionic clay wherein an ~~aluminium~~-aluminum source and a magnesium source are reacted in aqueous suspension to obtain an anionic clay, the ~~aluminium~~-aluminum source comprising two types of ~~aluminium~~ aluminum-containing compounds wherein one type of ~~aluminium~~ aluminum-containing compound is ~~aluminium~~-aluminum trihydrate or its thermally treated form. ~~Said~~-The magnesium source may be composed of a solution of a magnesium salt, a solid magnesium-bearing compound or a mixture of the two. Reaction between the Mg source and ~~aluminium~~-aluminum source results in the direct formation of an anionic clay. ~~Said~~-The reaction takes place at room temperature or higher. At temperatures higher than 100°C, the reaction is preferably carried out under autogeneous conditions. In the method according to the invention carbonate, hydroxyl, or other anions or mixtures thereof, either provided within the reaction medium for example by feeding a soluble salt to the reactor or absorbed during the synthesis from the atmosphere, are incorporated into the interlayer region as the necessary charge-balancing anion.

Page 11, lines 3-7:

Wherein m and n have a value such that $m/n = 1$ to 10, preferably 1 to 6, and b has a value in the range of from 0 to 10, generally a value of 2 to 6 and often a value of about 4. ~~X~~
X_{n/z}^{z-} may be CO₃²⁻, OH⁻ and any other anion normally present in the interlayers of anionic clays. It is more preferred that m/n should have a value of 2 to 4, more particularly a value close to 3.

Page 11, lines 9-14:

Since the process disclosed ~~in this patent~~ herein does not require washing of the product or filtering, there is no filtrate waste or gaseous emissions (e.g. from acid decomposition), making the process particularly environmental-friendly and more suited to the environmental constraints which are increasingly imposed on commercial operations. The product can be spray dried directly to form microspheres or can be extruded to form shaped bodies.

Page 11, line 16 - page 12, line 27:

~~Aluminium~~-Aluminum source

The present invention includes the use of two types of ~~aluminium~~ aluminum-containing compounds wherein one type of ~~aluminium~~ aluminum-containing compound is crystalline ~~aluminium~~ aluminum trihydrate (ATH) or its thermally treated form. An example of ~~aluminium~~ aluminum trihydrate is gibbsite (for instance provided by Reynolds Aluminium Company RH-20® or JM Huber Micral ® grades). Also BOC (Bauxite Ore Concentrate), bayerite and nordstrandite are suitable ~~aluminium~~ aluminum trihydrates. BOC is the cheapest alumina source. The alumina trihydrate is preferred to have a small particle size. Thermally treated forms of gibbsite can also be used. The thermally treated (calcined) ~~aluminium~~ aluminum trihydrate is readily obtained by thermally treating ~~aluminium~~ aluminum trihydrate (gibbsite) at a temperature ranging from 100 to 800°C for 15 minutes to 24 hours. In any

event, the calcining temperature and time for obtaining calcined ~~aluminium-aluminum~~ trihydrate should be sufficient to cause a measurable increase of the surface area in view of the surface area of the gibbsite as produced by the Bayer process which is generally between 30 and 50 m²/g. It should be noted that within the concept of this invention flash calcined alumina is also considered to be a thermally treated form of ~~aluminium-aluminum~~ trihydrate, although generally it is considered a very specific alumina. Flash calcined alumina is obtained by treating ~~aluminium-aluminum~~ trihydrate at temperatures between 800-1000°C for very short periods of time in special industrial equipment, as is described in US Patent Nos. 4,051,072 and US-3,222,129. When using ~~aluminium-aluminum~~ trihydrate other ~~aluminium-aluminum~~-containing compounds such as oxides and hydroxides of ~~aluminium-aluminum~~, (e.g. sols, thermally treated ~~aluminium-aluminum~~ trihydrate including flash calcined alumina, gels, pseudo-boehmite, boehmite) ~~aluminium-aluminum~~ salts such as ~~aluminium-aluminum~~ nitrate, ~~aluminium-aluminum~~ chloride, ~~aluminium-aluminum~~ chlorohydrate and sodium aluminate are added as the second type of ~~aluminium-aluminum~~-containing compound. Said ~~The other-aluminium-aluminum~~-containing compounds may be soluble or insoluble in water and may be added to the ~~aluminium-aluminum~~ trihydrate or it may be added to the reactor separately as a solid, a solution or as a suspension. When using a thermally treated ~~aluminium-aluminum~~ trihydrate also other ~~aluminium-aluminum~~-containing compounds are added such as the ones described above and of course ~~aluminium-aluminum~~ trihydrate and other thermally treated forms thereof. Said ~~The other aluminium-aluminum~~ sources may be added to the thermally treated ~~aluminium-aluminum~~ trihydrate or it may be added to the reactor separately as a solid, a solution or as a suspension. Preferably, the ~~aluminium-aluminum~~ source is added to the reactor in the form of a slurry. In particular we emphasize that there is no need to use a peptizable alumina source (gibbsite is not peptizable) and as a result no need to add either mineral or organic acid to vary the pH of the mixture.

Page 13, lines 14-19:

Because of its simplicity, this process is particularly suitable to be carried out in a continuous mode. Thereto an ~~aluminium~~-aluminum source and a magnesium source are fed to a reactor and reacted in aqueous suspension to obtain an anionic clay. In the case of a batch process the ~~aluminium~~-aluminum source and magnesium source are added to the reactor and reacted in aqueous suspension to obtain an anionic clay.

Page 13, line 20 - page 14, line 3:

Within the context of this invention a reactor is considered to be any confined zone in which the reaction between the ~~aluminium~~-aluminum source and magnesium source takes place. The reactor may be equipped with stirrers, baffles, ~~eteetera~~-etc. to ensure homogeneous mixing of the reactants. The reaction can take place with or without stirring, at ambient or at elevated temperature and at atmospheric or elevated pressure. Usually, a temperature between 0 and 100°C is used at or above atmospheric pressure. It is preferred to carry out the process at temperatures above 50°C rather than at room temperature, because this results in anionic clays with sharper peaks in the x-ray diffraction pattern than anionic clays obtained at room temperature. The reactor may be heated by any heating source such as a furnace, microwave, infrared sources, heating jackets (either electrical or with a heating fluid), lamps, ~~eteetera~~-etc.

Page 14, lines 5-16:

~~Said~~-The aqueous suspension in the reactor may be obtained by either feeding slurries of the starting materials, either combined or separate, to the reactor or adding magnesium source to a slurry of alumina source or vice versa and feeding the resulting slurry to the reactor. It is possible to treat, for instance the ~~aluminium~~-aluminum source slurry at elevated temperature and then add either the Mg source per se, or add the Mg source in a slurry or solution either to the reactor or the ~~aluminium~~-aluminum source slurry. Given particular

facilities which might be available, the process can be conducted hydrothermally. This is particularly advantageous, because it ~~this~~ is faster and a higher conversion is obtained. There is no need to wash or filter the product, as unwanted ions (e.g. sodium, ammonium, chloride, sulfate) which are frequently encountered when using other preparation methods, are absent in the product.

Page 14, lines 17-23:

In a further embodiment of the invention, the process is conducted in a multi-step process, e.g. a slurry of ~~aluminium~~-aluminum source and magnesium source is treated thermally in a first reactor at a mild temperature, followed by a hydrothermal treatment in a second reactor. If desired a preformed anionic clay may be added to the reactor. ~~Said~~-The preformed clay may be recycled anionic clay from the reaction mixture or anionic clay made separately by the process according to the invention or any other process.

Page 14, line 25 - page 15, line 1:

If desired, organic or inorganic acids and bases, for example for control of the pH, may be added to the reactor or added to either the magnesium source or the ~~aluminium~~-aluminum source before they are added to the reactor. An example of a preferred pH modifier is an ammonium base, because upon drying no deleterious cations remain in the anionic clay.

Page 15, lines 3-10:

If desired, the anionic clay prepared by the process according to the invention may be subjected to ion exchange. Upon ion exchange the interlayer charge-balancing anions are replaced with other anions. ~~Said~~-The other anions are the ones commonly present in anionic clays and include pillaring anions such as $V_{10}Q_{28}^{-6}$, $Mo_7O_{24}^{6-}$, $PW_{12}O_{40}^{3-}$, $B(OH)_4^-$, $B_4O_5(OH)_4^{2-}$, HBO_4^{2-} , $HGaO_3^{2-}$, CrO_4^{2-} . Examples of suitable pillaring anions are given in

US Patent No. 4774212 which is included by reference for this purpose. ~~Said~~The ion exchange can be conducted before or after drying the anionic clay formed in the slurry.

Page 15, line 17 - page 16, line 1:

For some applications it is desirable to have additives, both metals and non-metals, such as rare earth metals, Si, P, B, group VI, group VII, alkaline earth (for instance Ca and Ba) and/or transition metals (for example Mn, Fe, Ti, Zr, Cu, Ni, Zn, Mo, Sn), present. ~~Said~~The metals and non-metals can easily be deposited on the anionic clay or the solid solution according to the invention or they can be added either to the alumina source or magnesium source which are added combined to the reactor or separately. The metals and non-metals can also be added to the aqueous suspension in which the reaction takes place. Suitable sources of metals or non-metals are oxides, halides or any other salt such as chlorides, nitrates-eteetera etc. In the case of a multi-step process the metals and non-metals may be added in any of the steps. ~~Is~~It can be especially advantageous for controlling the distribution of the metals and non-metals in the anionic clay.

Page 16, lines 19-21:

This comparative example illustrates the co-precipitation method where Mg and Al salt solutions are added to a solution of base. (US Patent No. 3 979 523, Assignee Kyowa Chemical Industry, Japan)

Page 19, lines 4-11:

16.27 g gibbsite and a sample of 5.13 g gibbsite previously calcined at 400°C were slurried in 400 g ~~deionised~~deionized water. To this a slurry of 27.2 g MgO powder in 170 g ~~deionised~~deionized water was added and mixed in blender for ten minutes. The weight ratio of gibbsite to calcined gibbsite was 70:30 and the overall Mg:Al ratio in the slurry was 2.3. The pH was adjusted to 9.94 by the addition of ammonium hydroxide solution. Final slurry

solids = 7.0 wt%. The slurry was aged at 120°C for 18 hours and the product dried at 110°C.

See attached Figure 4.

Page 19, lines 15-22:

16.27 g gibbsite and a sample of 5.13 g gibbsite previously calcined at 400°C were slurried in 400 g ~~deionised~~-deionized water. To this a slurry of 27.2 g MgO powder in 170 g ~~deionised~~-deionized water was added and mixed in blender for ten minutes. The weight ratio of gibbsite to calcined gibbsite was 70:30 and the overall Mg:Al ratio in the slurry was 2.3. The pH was adjusted to 9.94 by the addition of ammonium hydroxide solution. Final slurry solids = 7.0 wt%. The slurry was aged at 200 psi (ca. 198°C) in a microwave oven for 60 minutes. The product was dried at 110°C.

Page 19, line 26 - page 20, line 4:

16.27 g gibbsite and a sample of 5.75 g flash calcined gibbsite CP-1.5 ® were slurried in 400 g ~~deionised~~-deionized water. To this a slurry of 27.2 g MgO powder in 170 g ~~deionised~~-deionized water was added and mixed in blender for ten minutes. The weight ratio of gibbsite to CP-1.5 was 70:30 and the overall Mg:Al ratio in the slurry was 2.3. The pH was adjusted to 9.87 by the addition of ammonium hydroxide solution. Final slurry solids = 7.0 wt%. The slurry was aged at 120°C for 18 h and the product dried at 110°C. See attached Figure 5.

Page 20, lines 8-15:

16.27 g gibbsite and a sample of 5.75 g flash calcined gibbsite CP-1.5 ® were slurried in 400 g ~~deionised~~-deionized water. To this a slurry of 27.2 g MgO powder in 170 g ~~deionised~~-deionized water was added and mixed in blender for ten minutes. The weight ratio of gibbsite to CP-1.5 was 70:30 and the overall Mg:Al ratio in the slurry was 2.3. The pH was adjusted to 9.87 by the addition of ammonium hydroxide solution. Final slurry solids =

7.0 wt%. The slurry was treated at 200 psi (ca. 198°C) in a microwave oven for 60 minutes. The product was dried at 110°C.

Page 20, lines 19-25:

16.27 g gibbsite and a sample of 6.09 g Catapal A ® were slurried in 400 g ~~deionised~~ deionized water. To this a slurry of 27.2 g MgO powder in 170 g ~~deionised~~ deionized water was added and mixed in blender for ten minutes. The weight ratio of gibbsite to Catapal was 70:30 and the overall Mg:Al ratio in the slurry was 2.3. The pH was adjusted to 9.96 by the addition of ammonium hydroxide solution. Final slurry solids = 7.0 wt%. The slurry was aged at 120°C for 18 hours and the product dried at 110°C. See attached figure 6.

Page 21, lines 4-10:

16.27 g gibbsite and a sample of 6.09 g Catapal A ® were slurried in 400 g ~~deionised~~ deionized water. To this a slurry of 27.2 g MgO powder in 170 g ~~deionised~~ deionized water was added and mixed in blender for ten minutes. The weight ratio of gibbsite to catapal was 70:30 and the overall Mg:Al ratio in the slurry was 2.3. The pH was adjusted to 9.96 by the addition of ammonium hydroxide solution. Final slurry solids = 7.0 wt%. The slurry was treated at 200 psi (ca. 198°C) in a microwave oven for 60 minutes. The product was dried at 110°C.

Changes to Claims:

Claims 1-3 and 6-8 are canceled.

Claims 16-25 are added.

The following is a marked-up version of the amended claims:

4. (Amended) A- ~~The process according to any one of claims 1-3~~ claim 23, wherein the ~~aluminium~~ aluminum source comprises ~~aluminium~~ aluminum trihydrate and thermally treated ~~aluminium~~ aluminum trihydrate.

5. (Amended) A-The process according to any one of claims 1-4 claim 23,
wherein the magnesium source is at least one selected from the group consisting of MgO,
magnesium oxide and/or Mg(OH)₂ and/or and MgCO₃.
9. (Amended) A-The process according to any one of claims 1-10 claim 23,
wherein metals or non-metals are fed to the reactor.
10. (Amended) A-The process according to claim-11 9, wherein the metals or
non-metals are added to an ~~aluminium~~ aluminum source slurry.
11. (Amended) A-The process according to claim-11 9, wherein the metals or
non-metals are added to a magnesium source slurry.
12. (Amended) A-The process according to any one of claims 1-11 claim 23,
wherein the anionic clay is subjected to an ion-exchange treatment.
13. (Amended) A-The process according to any one of claims 1-12 claim 23,
wherein the anionic clay is ion exchanged with pillaring anions such as $V_{10}O_{28}^{6-}$ and
 $Mo_7O_{24}^{6-}$.
14. (Amended) A-The process according to any one of claims 1-13 claim 23,
wherein metals or non-metals are deposited on the anionic clay.
15. (Amended) A-The process for the preparation of a Al-Mg-containing solid
solution and/or spinel, wherein comprising subjecting an anionic clay obtained by any one of
the processes-process of claims 1-15-claim 23 is subjected to a heat-treatment at a
temperature between 300 and 1200°C.